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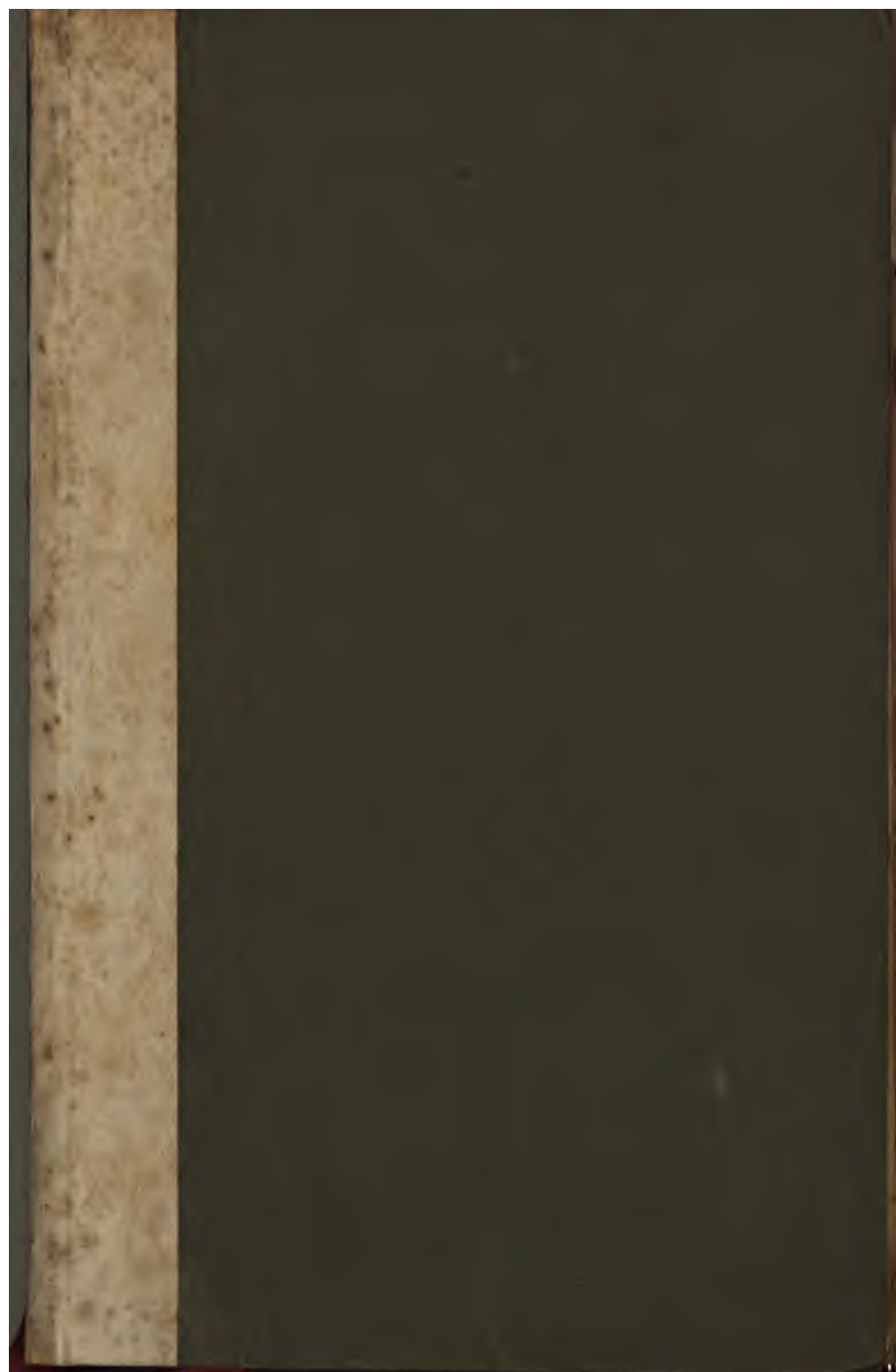
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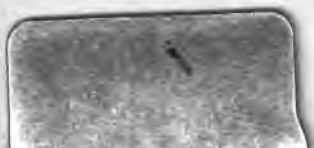
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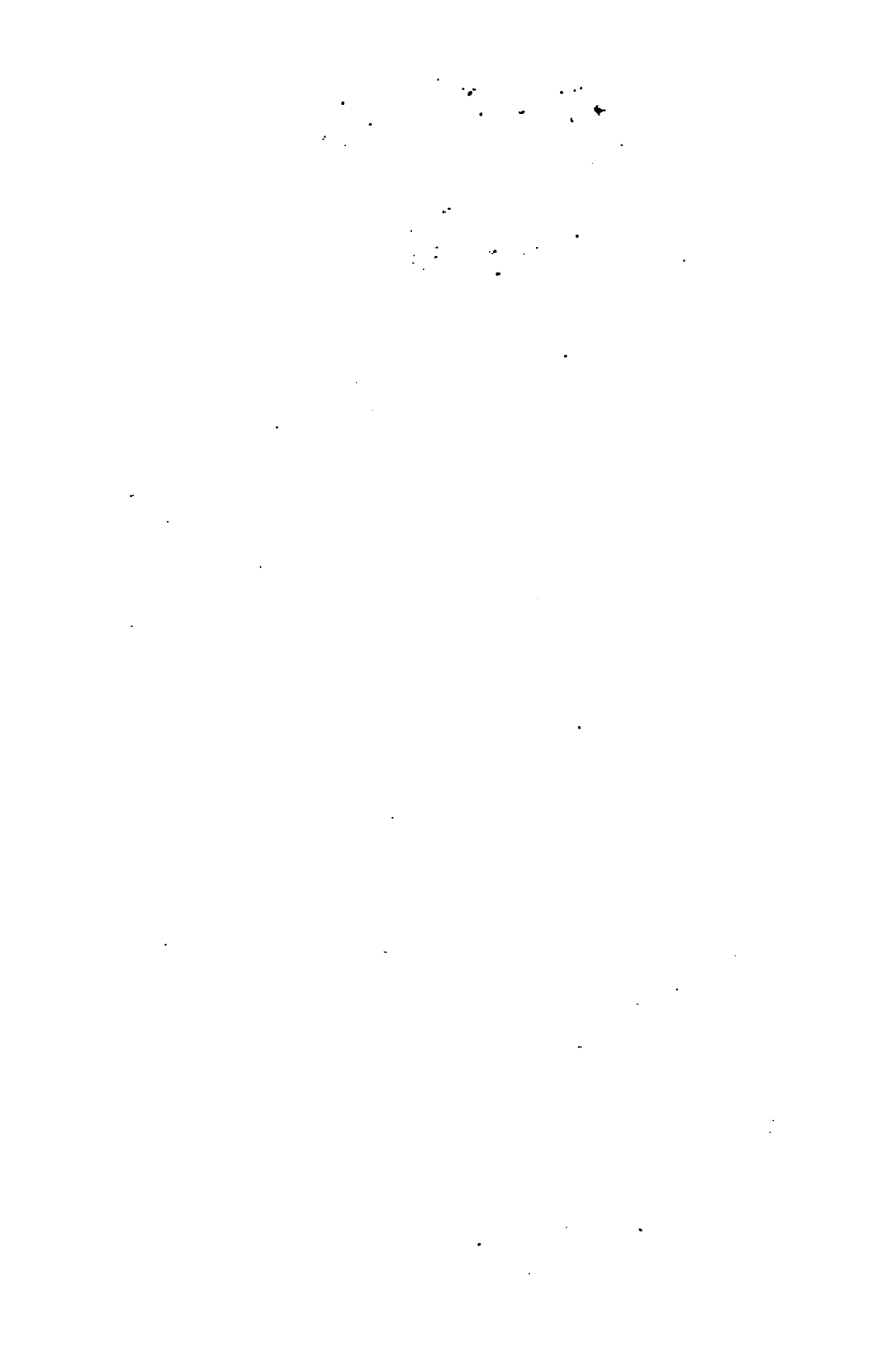
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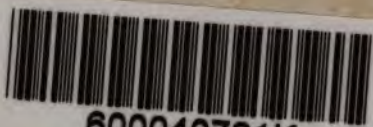




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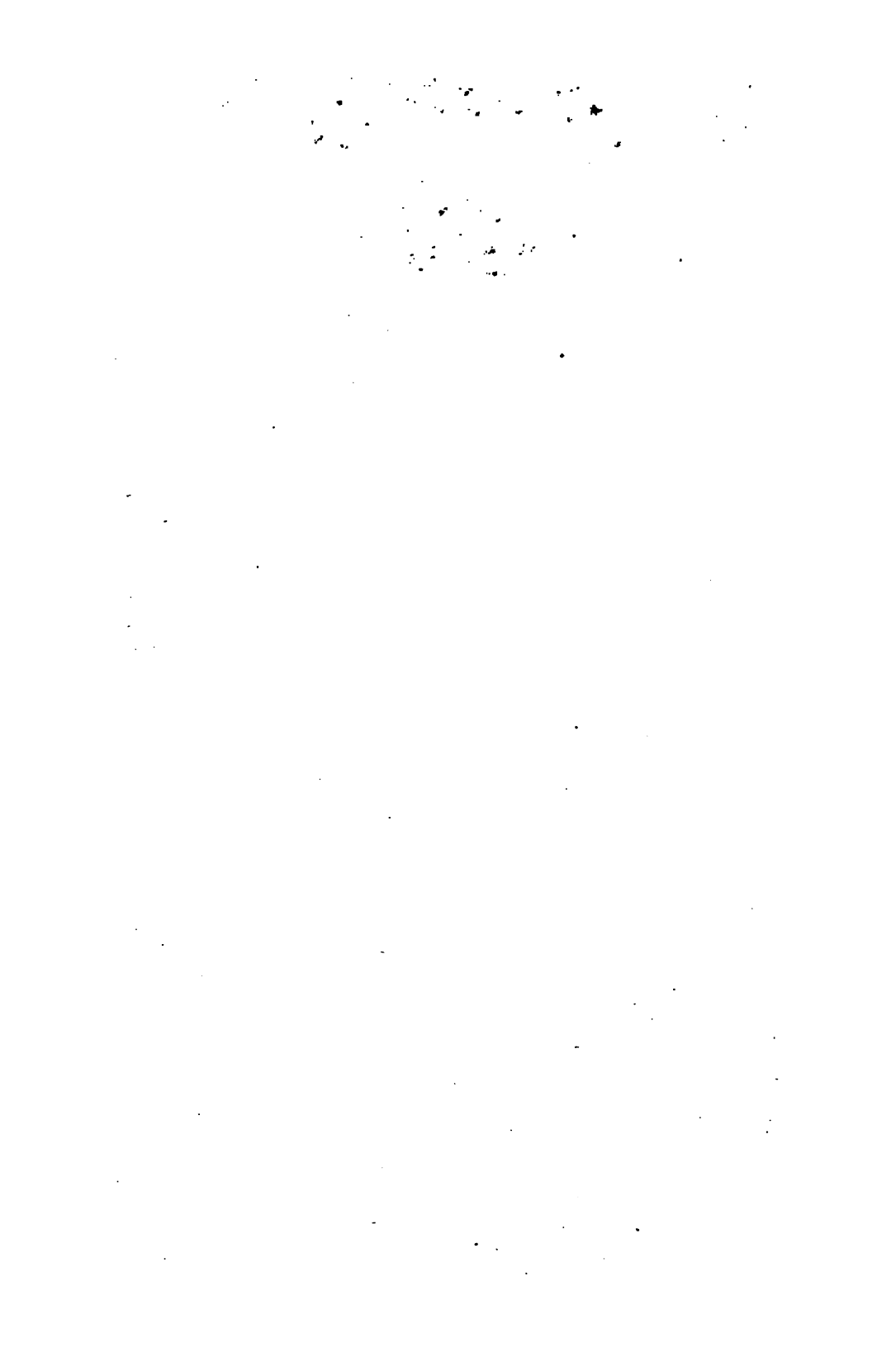


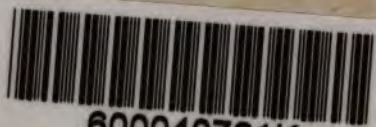




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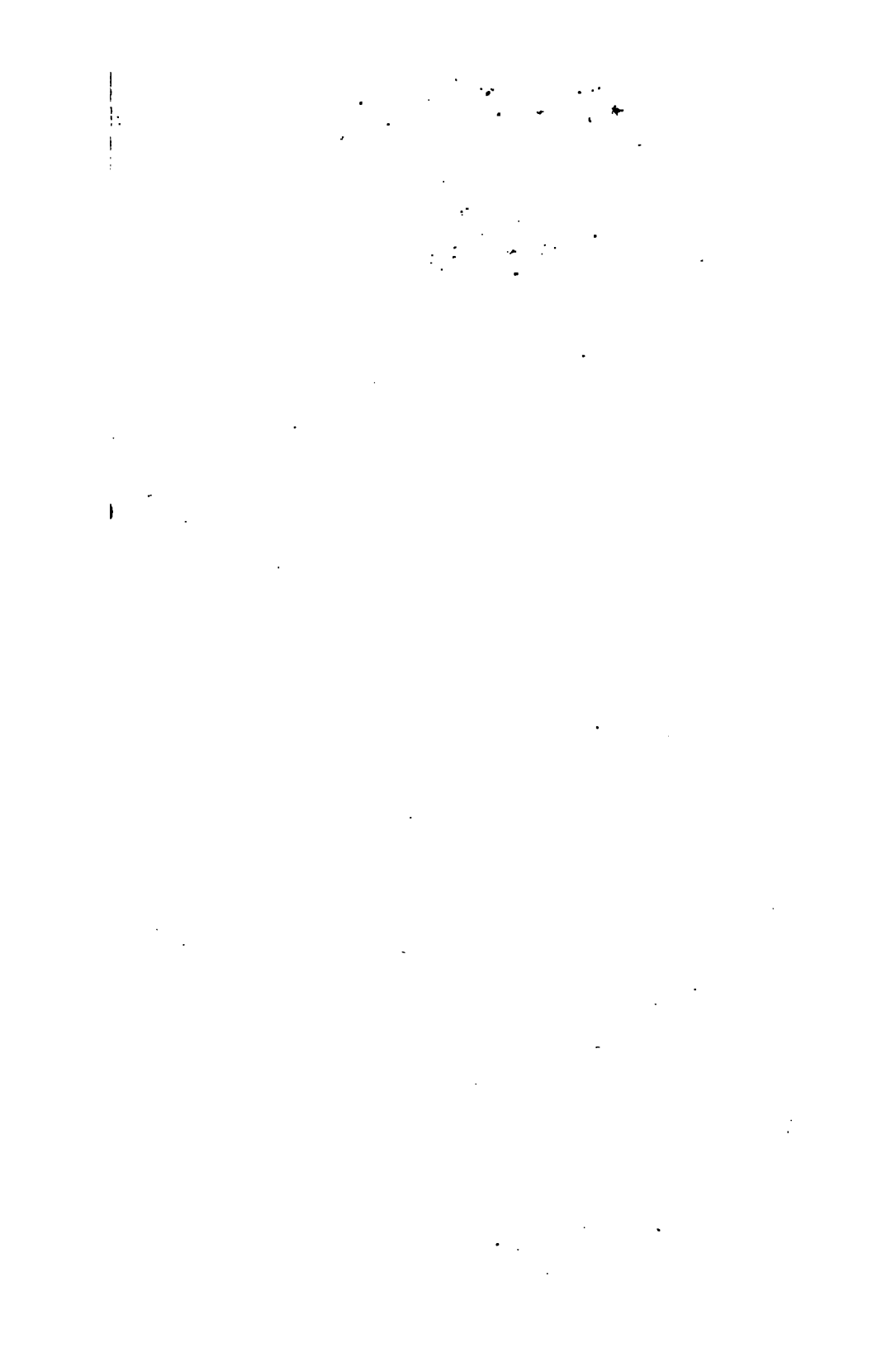






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inhabited places, where the boiling lime could not be used. I thought it no more than justice to myself, and the world in general to make it public; by which means, not only rooms, and all places of confinement, where the air may be fouled, in this neighbourhood, or even in this country; may be cleared and rendered safe, but also in other parts of the world at a greater distance.

And although the use of the shower machine alone, may not always answer the effect, of entirely purifying infected and confined air; yet, I hope, from the apparent success that followed its application here; it may be at least numbered amongst the useful and easy means for effecting such desirable purposes.

Persons concerned in keeping and superintending such places, will reflect with themselves, how far my observations correspond with their own ideas; and will adopt them accordingly, that they may render such services a blessing to mankind in general.

The importance of considerations of this kind, which seem to be suggested for the good of mankind; and in particular for that part of them, who, under the strictest confinement, have the least opportunity of relief; some of whom may, and often are found to be innocent; will, I hope, apologize for the many inaccuracies that may be found in the following sheets; which may have escaped my observation.

A committee was appointed to collect a subscription, and to distribute the collection for the use of the prisoners, on such necessaries as were thought most requisite; and a small sum reserved for the discharged prisoners to bear their expences home, that they might not be tempted, for want of money, to repeat a crime for which they had so lately been confined.

The subscription began in Maidstone, and was liberally supported by the principal gentlemen and ladies of this county, 'till a sum of *three hundred and fifty-one Pounds ten shillings and four-pence* was collected.



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S O M E

# CONSIDERATIONS

O N

THE DIFFERENT WAYS OF REMOVING  
CONFINED AND INFECTIOUS AIR.

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THE contagious fever in the prison of this town during the last winter, was an object of attention, not only to the committee appointed for the relief of the prisoners, but to the inhabitants of the town, and county in general. In the months of January and February the fever proved so infectious and obstinate, that it was supposed, that this prison was more particularly hazardous and alarming to those who had the business of it to attend, than any other county prison; although it had been duly visited, situated in a healthy airy spot, and not the most incommodious: But having lately perused a pamphlet, published by Sir GEORGE PAUL, *on the defects of prisons*, where

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there is frequent mention made of the distress and misery brought on the prisoners in Gloucester gaol, from fevers induced by confinement, the want of cleanliness, and proper accommodations necessary to support life and prevent disease : It appears from it, that other prisons have been subject to like misfortunes with that in this town.

While such fevers rage in a prison, no person is safe who is obliged to attend it.

Debtors for very trifling sums, and prisoners put in under very slight, and sometimes ill-founded charges, are equally liable to the infection ; and as Sir GEORGE mentions, “ It frequently happens “ that the verdict of our honourable acquittal is “ announced to a wretch expiring in agonies of “ pestilential disease, or so reduced, by hunger and “ despair, that the freedom we award him is become a thankless boon.”

The same gentleman observes, by way of proof of what he adduces, that, “ at the last assizes “ (in Gloucester) eleven bills were found against “ prisoners in such a bad state of health that they “ could

“ could not take their trials; and it is a fact, that  
 “ two prisoners were expiring, whilst the grand  
 “ jury were examining their indictments, and  
 “ were actually dead before the bills were returned  
 “ to court.” In another place Sir GEORGE  
 mentions “ during the last ten months, fourteen  
 “ prisoners have died of the small pox, and gaol  
 “ distemper, of whom seven were persons uncon-  
 “ victed of any crime.—Three were fines.—Three  
 “ debtors.—And one convict.”

The same gentleman when treating of the hard-  
 ships of certain descriptions of prisoners mentions  
 that the gaol fever “ is sometimes the eventual  
 “ punishment for bastardy; for snaring a hair;  
 “ for avoiding a turnpike; for selling a pint of  
 “ ale. That three persons under this description  
 “ have actually died of the distemper within the  
 “ last eight months.”

The military and naval service is in danger  
 of suffering by such diseases, and have suffered  
 much in times past.—Sir GEORGE mentions his be-  
 ing authentically informed by an officer in the war  
 before last, that a regiment of seven hundred men

was raised for the West India service ; many of the men being taken from prisons ; and that the gaol fever broke out among them after their embarkation, and only forty men of the whole regiment arrived at the destined port. Doctor LYND, in his *Essay on the health of Seamen*, asserts “ that “ the source of infection to our fleets and armies, “ are undoubtedly, our jails. The first English “ fleet sent last war to America lost by it two “ thousand men.” In this particular the countries on the continent, have remarkably the advantage of this island, as Mr. HOWARD observes, that “ the gaol distemper is not known in the prisons “ abroad.”

The great danger that the judges and other gentlemen concerned, are liable to, as well as the spectators, who are always numerous at trials, is evident from the history of the dangerous effects of trying prisoners when so infected. In the year 1577, at the assizes at Oxford, which is called *the Black Assize* from its fatal consequences ; “ all who “ were present died in forty-eight hours, the judge, “ the sheriff, and about three hundred others.”  
(Baker's Chronicle, p. 853.)

At

At Taunton in 1730, some prisoners infected the court, and the judges, the sheriff, a serjeant, and some hundred others died. The history of the melancholy affair of the Old Bailey in 1750 is still fresh in the memory of hundreds, where it is mentioned that "many people who were in the court, were sensibly affected with a very noisome smell. Within a week after the sessions, many were seized with a fever of a malignant kind, and few who were seized recovered. The persons who died, were Sir Samuel Penant, lord mayor, the two judges, Sir Thomas Abdey of the Common Pleas, and Mr. Clerk, a baron of the Exchequer; Sir Daniel Lambert, alderman; a gentleman of the bar; the under sheriff; several of the jury; and about forty others." (Foster 74.)

Sir GEORGE PAUL observes that Mr. HOWARD has computed that many more are destroyed by the gaol fever than by executions in this kingdom: And the calculation holds very strongly in Gloucestershire; where, it appears that of late the proportion has been as three dead of the distemper to one executed. The proportion has not been so great  
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at the affizes in Maidstone, as out of one hundred and six felons, seven were executed, and fourteen died of the distemper.

There are many distressing consequences attending the gaol fever: Not only the friends of those who are ill in prison on coming to visit them are frequently seized with it and die; but they communicate it to others; also, prisoners discharged after trial convey the infection to others, and often die of it themselves, after they are acquitted. Mr. HOWARD observes that "at Axminster in 1755, " a prisoner discharged from Exeter gaol infected " the whole family with the gaol disease, of which " two died; and many others in the town." Sir GEORGE PAUL mentions. " At the spring assize, " bills were found against eleven prisoners, who, " suffering at that time under the gaol disease, " were deprived of the benefit of the sacred privilege of their *habeas-corpus*. Of these eleven persons thus extrajudicially sentenced to a further " six months captivity, (under circumstances above " described) three died without trial, four on trial " were found innocent, and four only convicted. " There are now several prisoners who are on the  
" point

“ point of death without trial. Ten have died of  
 “ the small pox within the last five months, besides  
 “ the number unknown, to whom it has been  
 “ doubtless communicated by prisoners returning  
 “ to their families. So fatal, indeed, is this dis-  
 “ ease known to be, (when under prison attention)  
 “ that, it is a known fact, prosecutors have neglect-  
 “ ed the proceedings for a trial, considering their  
 “ business as completed in a summary way, on  
 “ hearing that their culprit was sick in prison.”  
 Many distressing cases of this nature are related by  
 Mr. HOWARD and Sir GEORGE PAUL, one in  
 particular I shall transcribe.

“ Joseph Beard, (a cripple) and the wife of  
 “ John Witts, of the parish of Stroud; having  
 “ been present at a trifling affray, were, with many  
 “ others, indicted for a riot. On their appearance  
 “ for trial the matter was accommodated; but they  
 “ (ignorant of the consequences) left the court with-  
 “ out discharging their recognizance. In due  
 “ course of proceedings, their names were reported  
 “ as elcheated to the Exchequer, a writ in conse-  
 “ quence issued, and Beard, and Witts, the husband  
 “ (as answerable for the wife) were committed to  
 “ prison.

" prison. Beard immediately caught the small  
 " pox, and on his recovery was seized with the gaol  
 " fever, and, after lingering several weeks, died ;  
 " Witts at the point of death with the same disor-  
 " der, was carried home to his family, and now  
 " lies delirious, without hope of recovery."

In another part of the same tract, after having  
 spoken of the diseases of the prison, Sir GEORGE  
 mentions, " convinced that these miserable effects  
 " could not be confined within the walls of the  
 " prison, I made enquiry into the more remote  
 " consequences, and I found that within a space of  
 " four miles round my own house, three debtors,  
 " one poacher, and a fine, had actually died with-  
 " in the preceding ten days, of a fever brought  
 " from the prison : And that of eight other per-  
 " sons infected by them, one is since dead, and  
 " seven lie dangerously ill."

These are only some of the quotations which  
 might be taken from Sir GEORGE PAUL's pamphlet  
 of the defects of prisons, and the fatal consequences  
 of the gaol fever, both in prisons and in country  
 places, to which the infection is carried by prison-  
 ers

ers discharged: Nor was the infectious fever confined within the limits of the prison at Maidstone, but was in the same manner, carried into the country by prisoners set at liberty.

E. G. Discharged at the quarter-sessions, went to Town-Malling, about six miles distant; and was there taken dangerously ill of *the gaol distemper*, and died; although every attention possible was paid him by the medical gentlemen of that town. The beadle, John Fowler, who attended him more frequently than any other person, caught the same fever, and recovered, after having lain in a very dangerous condition for a long time. Robert Fowler, hair-dresser, received the infection from the deceased, and died. James Palmer was one of the persons who frequently visited the poor deceased prisoner, he was also taken with the fever and died. Mrs. Field, who from motives of humanity attended the deceased in his illness; caught the fever but recovered; as did likewise a servant man.

William Edmunds, a debtor, discharged, went to his home at Bredhurst, and there fell ill of the fever, and died.

—— Martin, of Tovil, frequently visited his brother while he lay dangerously ill of the fever in the prison; he also was taken with it, and died.

A publican's boy carrying beer to the prisoners in the pound of the court-hall, at the quarter-sessions, caught the fever, and recovered:—And nothing is more evident, than that the prisons in most parts of England, are in effect rather places of execution than places of confinement for trial.

It was not imagined here, that the gaol distemper was so general as it appears to be from Sir GEORGE PAUL'S observations; one of which is the following, “ It has been demonstrated in the  
 “ instance of a particular county, that, notwithstanding every attention of the gaoler to his  
 “ duty, its prisons are the sources from whence disease, pestilence, and infamy, are diffused through  
 “ the county, that they are oppressive to the unfortunate; and incompetent to the punishment of the  
 “ vicious;—we have the undeniable evidence of  
 “ Mr. HOWARD'S Reports, that these *defects* are  
 “ not peculiar to any one district; the enormous  
 “ excesses that daily encrease through the kingdom  
 “ dom

“ dom are sufficient indications that the consequences are *universal*.”

Sir GEORGE PAUL, in a very humane and generous manner proceeds to consider the great difference there is between the prisons in England, and in most countries on the continent; and how far every good member of society, but particularly the magistrates are, in honor to their country and in the duty they owe to mankind, bound, to inspect into the condition of the prisoners of every gaol in their neighbourhood; and the more to enforce their duty quotes a law passed directly requiring the steady execution of such duties. As Sir GEORGE's book may not come into the hands of every one in this part of the country, I shall transcribe that part of the law therein taken notice of.

By 14 GEO. 3. c. 59. “ Whereas the malignant fever, commonly called the gaol distemper, “ is owing to a want of cleanliness and fresh air, “ &c. Be it enacted, that the justices, in their “ sessions, shall order the walls and ceilings of the “ different cells to be scraped and white-washed

“ once in the year, at least; and supplied with fresh  
 “ air by hand ventilators or otherwise; and shall  
 “ order two rooms in each prison to be set apart  
 “ for the sick; that they shall order warm and  
 “ cold baths to be provided, and no prisoner to  
 “ go out without being first washed; they shall  
 “ appoint an experienced surgeon or apothecary  
 “ to each prison, who shall report to the quarter  
 “ sessions the health of the prisoners.”

So far is this law from being complied with,  
 that Mr. HOWARD observes “ he found few in-  
 “ stances of inspection of the gaols by magistrates  
 “ on account of the danger attending them. And  
 “ that he found one instance of an apothecary  
 “ who stipulates in his bargain, not to be obliged  
 “ to visit the cells.”

Mr. HOWARD relates that in Cambridge town  
 bridewell “ in the spring 1779, seventeen women  
 “ were confined in the day time, and some of them  
 “ at night, in the work-room, which has no fire  
 “ place, or sewer. This made it extremely offen-  
 “ sive and occasioned a fever or sickness among  
 “ them, which alarmed the *Vice Chancellor*, who  
 “ ordered

“ ordered them all to be discharged; two or three  
 “ of them died within a few days.”

Many people express surprize, and wonder why the gaol fever is more frequent and fatal in our prisons now, than some years back, and are ready to ascribe it to the ignorance or inattention of the surgeons; however a little consideration of the cause of this fever will soon explain that matter. The number of prisoners now in most jails exceeds the number that was in them five years ago, by more than one half.—And it is generally known that crowding men in a narrow compass without change of air, most frequently brings on such disorders.—In 1773 Mr. HOWARD visited the prison in this town, and the number of prisoners was at that time as follows, “ April 16, debtors 15.—“ Felons 23, including convicts.”—Mr. HOWARD adds, “ I found the gaoler attentive to cleanliness and regularity.” The number of felons last lent assize was 106, debtors 29, more than three times as many as five years ago.

As to the causes and cure of the gaol fever, they have been written upon so fully by Dr. Monro  
 and



and Sir John Pringle, that it would be unnecessary to say any thing upon those subjects in this pamphlet, as those books are in the hands of most people, and have superseded any remark that I could pretend to make.

The principal object is to remove the contagious foul air.

As to human contagion, the nature of it does not seem to be well understood, it not being an object of our senses; nor can we examine or make any experiments upon it to discover its qualities. The specific nature of that contagious matter which occasions these putrid disorders is hard to be described, and the variety which may have appeared in the symptoms of persons affected by them depends, probably more on the difference of climate, season, and the peculiar constitution of different people; than on any specific difference in the original quality of the infectious matter itself. It is well known that the vapour or perspiration which constantly flows out from all parts of the human body, through the pores of the skin, if long confined in the same room or place without mixing with fresh air, will  
at

at last become infectious and bring on a fever of the most dangerous kind. This is proved by the experience of most surgeons who have attended hospitals or prisons.

And the complaint having appeared in different places and at different times of the year, shews that the cause of it is generated immediately among persons thus crowded, and not always conveyed from one place to another by infection, as some other infectious diseases are.

From what has appeared among the sick of the prison of this town, one is rather led to suppose that the virulence of the contagion is much more influenced by the numbers thronged together, than by the season of the year; as during the summer 1783, in the month of July the weather was very hot, and the air close and thick, when the gaol fever appeared here in the prison, yet it did not spread with one fourth part of the rapidity that it did in January following, when the whole surface of the earth was covered with snow; occasioned evidently by the greater number of prisoners in the winter than in the summer.

Although

Although the infection in the prison of this town has been as powerful and fatal as in almost any instance where the attention and care have been equally good; yet it does not appear that it has ever been communicated to any person, except to those who have been very near the bodies of the infected, or in the direct current of the corrupt air; which was the case of Charles Cutbush, ——— Pendall, and ——— Pooley, carpenters, and William Cutbush, a smith, who mended the hole in the prison hospital, through which one of the felons had made his way out: Pooley, an elderly man died, the other three recovered.

It is well known and remark'd by every one who has had any experience of gaol infections and confined rooms, that the clothes either of the body or beds, become, through time, more infectious than the patients themselves; and that the disorder has been communicated at a distance from any infected place, by such clothes. Infectious particles thus generated seem to be the real cause of the gaol fever; and Mr. HOWARD in his appendix quotes a long passage from Dr. MEAD's works to prove this; which, as few people may  
have

have read Mr. HOWARD's book, and few or none, but medical people, have read MEAD's works, I shall take the liberty to transcribe. Dr. MEAD in his discourse on *pestilential contagion* observes ;

“ Nothing approaches so near to the first original  
 “ of *contagion*, as air pent up, loaded with damps,  
 “ and corrupted with filthiness, that proceeds from  
 “ *animal bodies*. Our common *prisons* afford us an  
 “ instance of this, in which very few escape, what  
 “ they call the *gaol fever* ; which is always attend-  
 “ ed with a degree of *malignity* in proportion to  
 “ the *closeness and stench* of the place. And it would  
 “ certainly very well become the wisdom of the  
 “ government, as well with regard to the health of  
 “ the town, as in compassion to the prisoners, to  
 “ take care, that all *houses of confinement*, should be  
 “ kept airy and clean as is consistent with the use,  
 “ to which they are designed. As *naughtiness* is a  
 “ great source of *infection*, so cleanliness is the  
 “ greatest preservative.”

Mr. HOWARD, remarks that he seldom or never saw any thing of the gaol fever abroad, although he had found prisoners in dungeons and cells, as foul and dirty as any in England, his own words

D are

are as follow, concerning the gaol fever. “ If I  
 “ were asked, what is the cause of the goal fever?  
 “ It would in general be replied, *the want of fresh  
 air and cleanliness*. “ But as I have found in a few  
 “ prisons abroad, cells and dungeons as offensive and  
 “ dirty as any I have observed in this country, where,  
 “ however, this distemper was unknown, I am oblig-  
 “ ed to look out for some additional cause for  
 “ its production. I am of opinion, that the sudden  
 “ change of *diet* and *lodging* so affects the *spirits* of  
 “ new convicts, that the general causes of putrid fe-  
 “ ver exert an immediate effect upon them. Hence  
 “ it is common to see them sicken and die in a short  
 “ time, with very little apparent illness. Convicts  
 “ are generally stout and robust young men, who  
 “ have been accustomed to free diet, tolerable lodg-  
 “ ings, and vigorous exercise. These are ironed,  
 “ and thrust into offensive dungeons, some of them  
 “ without straw or other bedding; in which they  
 “ continue in winter sixteen or eighteen hours out  
 “ of the twenty-four, in utter inactivity, and immer-  
 “ sed in the noxious effluvia of their own bodies.  
 “ On this account the gaol distemper is always ob-  
 “ served to reign more in our prisons during the  
 “ winter

“ winter than summer ; contrary I presume, to  
 “ the nature of other *putrid diseases*. Their diet, is  
 “ at the same time low and scanty ; and the powers  
 “ of life soon become incapable of resisting so many  
 “ causes of sickness and despair.”

It has been an observation, and is well known to most people in the world, that ~~motion~~ communicated to the air prevents its corruption and carries off foul vapours which rise from the earth, from stagnant waters, and also which have been observed to rise from noxious plants and trees in general : But Dr. PRIESTLEY, and in particular Dr. INGEN-HOUSZ have found from many experiments, that, although plants and trees of all kinds send out a vapour which fouls the air, particularly at night ; yet they have a power of purifying the air in the day, by absorbing the noxious particles that float in it. Dr. INGEN-HOUSZ says “ It will, “ perhaps, appear probable that one of the great “ laboratories of nature for cleansing and purifying “ the air of our atmosphere, is placed in the substance of the leaves, and put in action by the influence of the light.” And not only so, but that vegetables have a power of generating and  
 D 2 emitting

emitting air four or five times more pure than common air; and which will serve four or five times longer for respiration than the common air we breathe, in general. The same ingenious writer in sec. IX, observes, " all plants possess a power of " correcting in a few hours, foul air unfit for respiration; but only in a clear day-light, or in " sun-shine." And the Doctor mentions in the same place, " This remarkable property of " plants is indeed very great; for in a few hours, " nay even sometimes in an hour and a half, " they purify so much a body of air, quite unfit " for respiration, as to be equal in goodness to " atmospheric air." The same author mentions in another place. " This power of plants extends " itself even to the worst of all airs in which an " animal finds his destruction in a moment; such " as is pure inflammable, and highly phlogificated " air."

The fine pure air generated by the leaves of the trees, is found to be heavier than common air, and of course descends to the surface of the earth; while most kinds of air fouled by being used by animals become lighter than the common air,  
ascend,

ascend, and are absorbed by the pores of the vegetables every where; so that there is a change of bad air into pure wholesome air, formed by the powers of plants, and all vegetables growing upon the face of the earth; and, perhaps this may be one reason why the gaol fever is more mortal in winter than in summer, as the leaves of the trees and the growth of the vegetables are in a great degree put a stop to.

In looking over Mr. HOWARD's account of the prisons abroad, I find that the prisoners were generally accommodated with clean and healthy food, both animal and vegetable; that the prisoners are frequently employed in some kind of manufacture, of which they profit a little, as they always are allowed a certain proportion of what they earn; this is a great advantage and encouragement, as it keeps the mind engaged to their employments, and prevents the ill effects that chagrin and despair inspire, which tend strongly to weaken and disorder the spirits and render the body more feeble, and less able to resist the power of infection; as it is well known that grief and despair preying continually upon the spirits, render the body weak  
and



and irritable, and predispose it to be more liable to the contagion with which they are constantly surrounded. Add to these observations, that the people on the continent are not brought up with such licentious notions of liberty as the people of this country, of course confinement is not such a distress to them. Also the inhabitants of our country are supposed to eat more animal food, and drink more strong beer than the inhabitants of the continent, by which a fullness of habit and a disposition to *scorbutus*, or a putrid state is much more readily brought on. And also the exercise of the body in their employment is of service to the foreign convict in keeping the circulation alive.

Cleanliness is an article so much insisted upon by every one, that it may not be improper to consider some of the circumstances wherein it consists; and they seem to be not very numerous; air, diet, clothing, and bedding, seem to comprehend the whole. As to air, Dr. MONRO observes, that whatever medicines or means are used, if the patient continues to breathe in an infected foul air, he has never found that any thing had the desired effect; and yet fresh air is not all that is wanting;  
since

since if there be any defect in point of diet, as there frequently is; if prisoners are supplied with bad or putrid meat, and poor coarse bread, vapid beer, or water not pure, or the victuals improperly dressed; the seeds of the complaint may be nourished and continued thereby.

It has been taken notice of, that contagion comes to a greater degree of virulence by being confined in the clothes of a person infected, than where it is immediately exhaled from the surface of the body or lungs; this shews the pressing necessity there is to have a change, and to have their clothes washed and fumigated as frequently as possible. As the covering by day should be cleansed and changed frequently, so should the bed clothes also undergo the same management. All old tattered bed clothes should be burnt or buried, and replaced by new ones, and the new clothes for the beds should also be changed every week and washed.

I am creditably informed by a person who was at Winchester all the time of the gaol fever among the French prisoners there, about three years since; that

that nothing seemed to answer properly until the bedding and clothes were changed and fresh clothes supplied, to which were added frequent washings, as all the prisoners who were at that time not infected were marched down every day to the river to bathe, by which they got their bodies clean of all *fordes*; and they had thereby exercise and breathed the fresh air. Of such consequence did the fresh clothing and bedding appear, that although the appartments were large and airy, together with a spacious airing ground, yet they continued to drop three or four every day, so that in the space of a month, one hundred and thirty or more prisoners died; and after the new clothes, together with other usual means which had been adopted before: The disorder seemed to give way almost directly. Mr. HOWARD speaks expressly concerning the necessity of clean bedding, and the bad effects of prisoners or others sleeping in their body clothes, and relates an observation which he had heard made by an old general. “ That he always “ found his men subject to illness and diseases when “ they lay in camps, *not* from *dampness* but from “ *lying in their clothes* and want of *proper bedding*; “ for that at the same time, all his officers had “ been

“ been quite healthy and well.” Mr. HOWARD adds “ whatever be the cause of this difference, “ whether a *more free perspiration* in bed, *taking off* “ *bandages*, or *ventilating of clothes*, I am fully convinced of the fact.” With regard to the great efficacy of washing, he, when speaking of Hertford gaol, says, “ in mentioning the gaol fever, I should “ have added, I was well informed that a prisoner “ brought out as dead, from one of the dungeons, “ on being *washed under the pump*, shewed signs of “ life, and soon after recovered. Since this I “ have known other instances of the same kind.”

It is certain that human contagion is retained in the filth and dirt which is lodged in dirty old clothes of prisoners, as well as on the *foldes* of the skin; and it has been a subject of doubt, whether the infectious matter does not require some subject as a vehicle to carry it, either in the air or on such rags: Now in the writings of Dr. PRIESTLEY and others it is mentioned, that as well as a great degree of contagion; there is also an exhalation of fixed air discharged from the body, particularly by the breath, and this is easily determined by a simple experiment. Let any person take a crooked glass

E tube

tube and put some lime water into it, so that at the most dependent part of the glass it shall be full, and then let the person blow his breath through the glass; by this means the lime will be precipitated and turn of a white turbid appearance; this effect is also produced by passing fixed air through the tube, which is a proof that there is fixed air always passing out from the lungs, whether in a state of health or not. Dr. INGEN-HOUSZ observes that the “ Abbè Fontana found, that an animal breathing in, either common or dephlogisticated air, renders it unfit for respiration, by communicating to it a considerable portion of fixed air, which is generated in the body, and thrown out by the lungs as excrementitious. This fixed air is easily absorbed by shaking it in common water, but infinitely more readily by the contact with quick lime water.” This discharge of foul air from the lungs, seems to be one considerable cause of rendering the common air noxious and unfit for respiration, as may be very easily observed by any person breathing for some time in a narrow close place. Even the flame of a candle is extinguished by it, and animals die in it in a very short time, and sometimes instantaneously, as has been proved  
in

in deep wells, caves, and in cellars; where the air is much confined, and where fermentation goes on.

Whatever may be the nature of fixed air, it seems highly necessary in the human body, but extremely dangerous if taken into the lungs; it seems to constitute at least, one part of the means that keeps the solids from passing into a state of relaxation and dissolution; this also appears to be the case in vegetables, as by fermentation the solution of the union of the parts of the vegetable is brought about, and at the same instant the fixed air is making its escape, and may be collected by an easy experiment.

(See Rees's Cyclopædia, at the article *Air fixed*.)

It is probable that something more is discharged from the lungs, and the surface of the bodies of sick persons, than merely fixed air; as during the course of a fever, particularly an infectious one; a discharge of something replete with the nature of the cause of the distemper may be supposed to happen, by the breath, and pores of the skin: As also, by some of the latest experiments it is found

that pure fixed air is heavier than common air; this infectious substance may perhaps be of the quality of inflammable air, which is much lighter than common air. Dr. PRIESTLEY has discovered inflammable air to arise from animal as well as vegetable and mineral bodies; (See Rees's Cyclopædia at *Air inflammable*.) and this serves to account for what we daily observe in practice, which is, that the infected air of prisons and hospitals always rises; as was particularly exemplified in the case of the people, who repaired the hole in the ceiling of the hospital from whence a man made his escape.

Dr. M'BRIDE endeavours by a variety of experiments to prove, that in the corruption of animal substances, a great quantity of fixed air is let loose; and that the same flesh when spoiled, may be sweetened by communicating fixed air to it again: This naturally leads to the observation, that, in putrid fevers where a dissolution seems to take place in the body, and where the respiration is quickened; a much greater quantity of this fixed air, with substances of other qualities are discharged; and that the air is much sooner rendered foul by persons ill of such complaints, than by those who are in health.

With regard to the condition of jails crowded with prisoners, and not well ventilated, which is generally the case, on account of the thickness of the walls, and the narrowness of the windows, the air is always foul; although it does not always produce infection or the gaol fever; and this foulness seems to consist of fixed air with some inflammable air; and no doubt a contagious matter or vapour, which seems to be the immediate cause of the gaol distemper, when it appears. What the nature of it is, and how it acts upon the human frame remains entirely undetermined; it however seems to accompany the foul air, and not in any instance which has happened in this place, appeared to have infected any person who had not been in the rooms where the prisoners were, or near some of those who were infected.

However infectious the contagious matters may be, yet they do not affect all people alike; some are taken ill on being very slightly exposed to the foul air, while others are in it for weeks unhurt; and there is an instance of one of the felons in the prison of this town, who attended upon the sick night and day for some months, and only had  
once



once a slight head-ach, and illnefs which confined him about twenty-four hours, and which he got rid of by a vomit, and the ufual medicines, bark and red wine.

With a view to purify places where the air is foul and in a fixed ftate, nothing feems more proper than a fubftance of fuch quality, that it may be generally applied, and at the fame time, have a power of abforbing, and of courfe, of altering the quality of fuch air: Thefe requifites are found in lime water; as from its cheapnefs it may be had in any quantity, and for the manner of applying it mention will be made hereafter. And from the experiment formerly noted, we find that fixed air and lime water have an attraction to each other, fo as to deftroy each others nature, and produce a new fubftance, which appears to be innocent.

In making lime water, it was formerly directed to put a gallon, or a gallon and a half of water to one pound of frefh burnt quick lime; but it appears from Dr. ALSTON's experiments, that one pound of quick lime is fufficient to make feventy-five gallons (i. e.) fix hundred pints of lime water,  
very

very good and fit for use. It has been thought necessary that the lime which is used should be fresh calcined, that the water should be hot, and poured on gently. Dr. ALSTON, who paid a great deal of attention to the process of making lime water, and drank it for a great many months together, took notice that, " it was generally believed, that in order to obtain good lime water, the quick lime must not only be recent and fully calcined, but also for one part of quick lime, only eight, ten, or, at most twelve parts of water taken; as if it could impregnate no more." But the Doctor says. " He has found by many experiments, that it is altogether indifferent, whether the water be hot or cold, poured on gradually, or at once, the water poured on the lime, or the lime thrown into the water; whether the quick lime be in shells, or flaked, or even exposed to the air for several months, for such quantities of the water as are commonly used; and if the quick lime be fresh, whether for one pound of it, eight, ten, twenty, fifty, or five hundred pounds of water be taken." The Doctor, for his own use, poured about eight pounds of boiling water, upon one pound of stone quick lime, in a glazed earthen vessel.

He

He drank about a pint and a half of this lime water, daily for about sixteen months, filling up the vessel, when necessary, with fresh water, sometimes hot and sometimes cold, without observing any difference in it: He observed, that the lime was not exhausted after two years and two months, nor was the water sensibly weaker (See Rees's Cyclopædia at the article, *lime water*.)

It is not proposed, however, to assert that lime will make as strong lime water after it has been long exposed to the air, as directly after burning, at least it will not make so much; as unslaked lime recovers its original quality from the air, and becomes inert if long exposed to it; but this effect only takes place on the surface of the lime, and does not become general, unless the lime be stirred about frequently and exposed to the air on every part of its surface.

From the observations of Drs. ALSTON and M'BRIDE, we find that lime water penetrates deeply into most substances, and absorbs the fixed air that it meets with; and on this account it must promise to be of great advantage to scour and wash  
the

the walls and floors of infected rooms with it, and thereby destroy the vehicle of infection: As we have endeavoured to shew that from the experience of the infection at this prison, the contagion never seemed to spread further than the foul air extended; for this reason it appears to be indispensibly necessary first of all, to exhaust the rooms infected, of their foul air; this seems to be the voice of all persons of eminence, who have had most experience in the gaol fever; and to strengthen this opinion, together with other means of purification used for that effect, I shall mention what I have met with in Mr. HOWARD's observations, who says, " after  
 " the gaol fever has prevailed in a prison, nothing,  
 " probably will be so effectual in destroying all re-  
 " mains of infection, as the mode of fumigation  
 " practised by the ingenious Dr. LIND, for infected  
 " ships." The following is an abstract from the Doctor's observations, which he favoured Mr. HOWARD with. " Charcoal fires should be lighted  
 " in the morning, and allowed to remain 'till the  
 " evening, and half a pound of brimstone thrown  
 " upon each, their smoke in the mean time being  
 " closely confined. They may be made in iron pots.  
 " The fumigation should be repeated every day for

“ a fortnight. Every evening after the fumigation,  
 “ the ports and hatchways should be opened, and the  
 “ inside of the ship washed with warm vinegar; and  
 “ after the last fumigation, before the men return to  
 “ the ship, the decks should be thoroughly scraped  
 “ and cleaned. If the infection has been very vio-  
 “ lent, the parts of the ship most exposed to it may  
 “ also be white-washed. Every thing ragged and  
 “ dirty should be destroyed, as also the clothes and  
 “ bedding of such as brought the infection into the  
 “ ship; the bedding of such as died of the fever, and  
 “ unless the infection has been very mild, the bed-  
 “ ding of such as have had the fever, though reco-  
 “ vered. The remaining clothes and bedding should  
 “ be purified, by being exposed twice a week to the  
 “ steams of brimstone and charcoal; or when the  
 “ brimstone might be supposed to injure the clothes,  
 “ they may be hung up in a close place, exposed to  
 “ the smoke of tobacco strewed on charcoal fires.  
 “ Linens, and such articles as will admit of being  
 “ wet, should after the first fumigation be steeped for  
 “ several hours in cold water or leys be well washed,  
 “ and then dried in open air. If during the fort-  
 “ night of this fumigation, any person is taken ill of  
 “ the fever, the fortnight should again commence  
 “ from

“ from the day on which the person leaves the ship;  
 “ Strict attention should be paid to the cleanliness  
 “ of the men, both in their persons and apparel;  
 “ such as are sluggish and dirty should be made to  
 “ bathe and clean themselves; and a sufficient quan-  
 “ tity of flops should be issued, that every man may  
 “ have a change of clothes.”

The fires in this manner of purification, will  
 have the best possible effect, as they rarify the air,  
 and cause it to pass out at any outlet that may be  
 for it to pass through; and at the same time, fresh  
 air is received. But this is practicable only on  
 board of ships or in hospitals, where they have a  
 power of removing the men from the infected  
 places, during the process; and not in a crowded  
 jail, as felons seldom or never have that privilege.

One would suppose that Dr. LIND and most  
 others of the faculty, who have given directions to  
 use vinegar and the fumes of sulphur, think that  
 the contagion is of a putrid nature, and that they  
 designed to correct it by the contrary qualities,  
 viz. those acids which are known to counteract  
 putrefaction; but although in the discharges from

the human body by the breath and perspiration, there may be putrid exhalations; yet it is not certain that the matter of the contagion itself is of that quality, and if it be true that the fixed air is the vehicle of the contagion, as it appears to have been here, the most proper method will be to adopt substances, which will have the greatest power in destroying and absorbing the fixed air; these seem to be particularly lime water, or any thing of a caustic alkaline nature, as quick lime and water, or leys; and the Doctor has also mentioned the steeping the linens in leys to purify them, as if he had been persuaded that fixed and foul air might be corrected thereby, particularly that which is confined in the clothes, which we have found to be in general more infectious than the patients themselves; and if lime water or leys, is more powerful in this particular, why not adopt it more generally, as it is so cheap an article?

The usual methods of fumigating with vinegar and different substances, as also discharging gunpowder, had been practised for sometime in the prison of this town, during the months of January and February, when the infection was so strong, that  
at

at one particular time there were between fifty and sixty persons unwell, including those who were dangerously ill, others fresh attacked, and the convalescents; yet nothing seemed to answer the desired effect until the use of the lime water was adopted, together with a more extensive use of what had been before applied; that is, the fumigations, and in particular the discharging greater quantities of gunpowder in all the wards, once or twice a day, whilst all the internal openings were close shut, and the external ones open. To what has already been taken notice of, it may be farther added, with respect to the change of clothes, that these were procured by the committee for superintending the prison, who exerted themselves very much, and persevered until a double suit of convenient and warm clothing was got for every one, both bed and body clothes; their old clothes, such as were not worth washing, being either burnt out of town, or buried deep in the earth; it was not thought proper to throw them into the river, as they might have been taken out and sold as old rags to the paper mills, with danger of spreading the infection.

A number of beds and bedding were also purchased, and the old beds were replaced by them;



and when the trials came on, each man had a change of new clothes to put on when coming into the court-hall, by which the dread of the infection was in a great measure removed from the minds of the people concerned.

Lime water and the manner of applying it, which will be described hereafter, occurred to me in consequence of a requisition of some of the members of a society lately instituted in this place, for the *diffusion of useful knowledge*; by whom I was desired to turn my attention to any thing that might be useful in removing the infection, which raged so much and so fatally at that time in the prison.

X After considering what had been done, it appeared that something was wanting to purify the air, by precipitating its contents; as the outlets were not sufficiently convenient to purify it by discharging the air, which was foul; and to let in fresh; to this purpose I met with an observation in Sir JOHN PRINGLE's treatise on the *Diseases* of the *Army*, who, when speaking of the face of the country of the Netherlands, and of the air and moisture and impurities in the air, mentions,  
 "Frequent

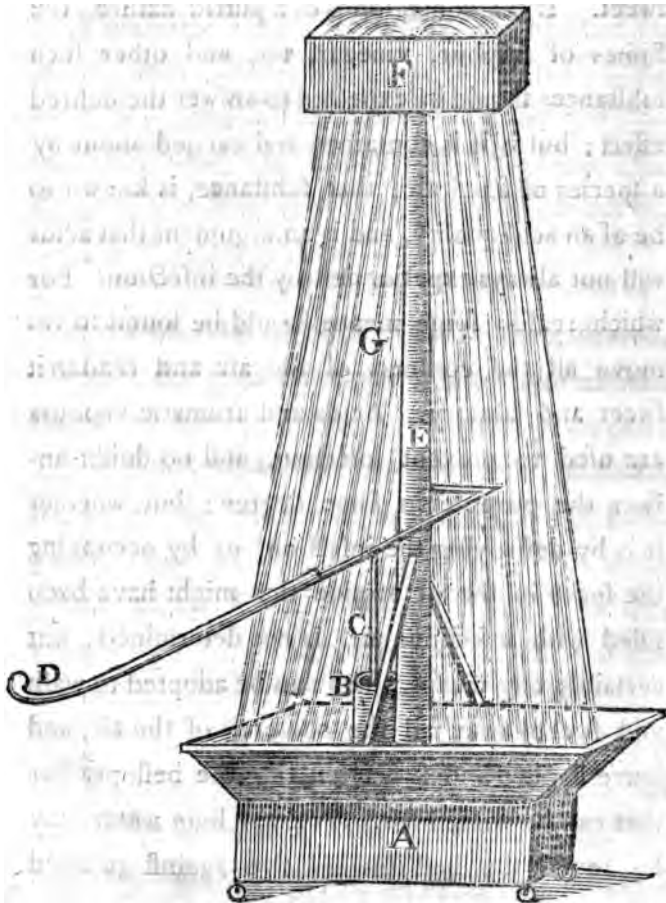
“ Frequent showers, during the hot seasons, cool  
 “ the air, check the rise of vapours, dilute and  
 “ refresh corrupted waters, and precipitate the  
 “ putrid and noxious effluvia.” This observation  
 may be made by any one, that after a shower, the  
 air generally appears more clear, and cleansed  
 from the smokey and other impurities that it was  
 loaded with before the shower. A procedure  
 something like this, is observed by people who go  
 down to clean deep wells, if they apprehend any  
 foul air, as frequently happens, they let down a  
 candle, by which they discover the state of the air  
 in their passage to the water; if the flame burns  
 clear all the way to the bottom, there is thought  
 to be no danger in going down; if the flame ap-  
 pears blue and grows smaller, it is a proof that the  
 air is unfit for breathing, and they throw down  
 quantities of water, by which they purify the air,  
 and render their descent safe: From which idea  
 I invented a machine to cause lime water, or any  
 fluid to pass from the upper to the lower parts of  
 the wards, in a shower, (without wetting the floor)  
 with a view to carry down the contents of the air,  
 according to Sir JOHN’s idea. (See plate the first)  
 A, the cistern, into which the lime water or vine-  
 gar

gar impregnated with antiseptic herbs is put.—B, the working barrel.—C, the piston rod.—D, the lever.—E, the ascending pipe, through which the liquor is forced into F, the reservoir; which is perforated with a hot iron to let the liquor fall in a shower as at G, into A, the cistern again; and repeated at different parts of the room, 'till it has past through as much of the confined air as possible; and over each bed, and such parts as it could not be wheeled to, it is directed, that a man force away by a large fan, the air of such places towards the purifier, to make room for that which has been corrected. This machine was used daily in the wards of the prison, and likewise in the hospital, when not too much incumbered with beds, to admit of its being worked.\*

So refreshing did the frequent showers of lime water appear to the confined men, that each eagerly expressed a desire of working the machine, that he might breathe the air thus purified, immediately from its being corrected, and after it had been used in one ward, one and all declared, it resembled the earth being cooled in a sultry hot day, by a  
hasty

\* All the parts of the machine can be taken apart for the conveniency of its being removed to different places.

hasty shower of rain ! add to this, while the men were in the court-yard, one ward every day was exhausted of its foul air, by boiling antiseptic vinegar and boiling lime, and fresh air admitted: The method of which see hereafter.



This

This has been found to answer for cleansing and cooling the air, much better than the discharging a great quantity of smoke and other vapours, which seem only to load the air still more without answering the purpose of purifying it, and rendering it sweet. If the contagion is of a putrid nature, the fumes of sulphur, vinegar, tar, and other such substances should be expected to answer the desired effect; but if it is contained and carried about by a species of fixed air; that substance, is known to be of an acid quality, and is an argument that acids will not always expel or destroy the infection. For which reason some means should be found to remove all the contents of the air and render it sweet and salutary. Acids and aromatic vapours are used to prevent infection, and no doubt answer the purpose in some degree; but whether it is by destroying the infection, or by occupying the space in the air around that might have been filled with infectious air, is not determined; but certainly any means which can be adopted to wash and sweep away all the contents of the air, and leave it pure and sweet must be the best purifier that can be wished for. Perhaps lime water may be found the best preservative against infected  
air

air for those whose employment may oblige them to go into it; by wetting a handkerchief, or a flannel, which is thicker and answers better to let the air pass through it, and by keeping it to the mouth and nostrils, so as to breathe through it, and so to strain the air used for breathing while in such places; if it answers the purpose it will be more fit, than vinegar and camphire, which are so strong that they affect the breath, when kept too near the nostrils and mouth, and do not answer the intention, if held at a distance.

It is a question which is desired to be answered, whether, the gaol distemper is more mortal now than it has been in the last forty or fifty years past? This I cannot undertake to determine, but with regard to the distemper here for the last forty years, as near as I can learn; it appears that in the year 1744 Mr. Carey, commenced gaoler, he says a slight putrid fever appeared in the prison at different times from prisoners brought from Newgate; and he thinks it was in the year 1748, when it raged violently, and carried off a great many, he caught the infection himself at that time, and recovered, after lingering along time. Robert

Burton, his turnkey died with it. Mr. Carey was keeper of the gaol eleven years, and had not the distemper a second time; but as the fever raged very much in 1755, he resigned, and his brother James Carey succeeded him, who caught the distemper and died of it. He was succeeded by Thomas Hook, a servant of William Champneys, esq. who soon after caught the fever and died. Mr. Ore the clergyman who attended the gaol about that time, was taken with the infection and died. John Stevens succeeded T. Hook, he caught the fever and recovered. Robert Stevens, his brother, the then and present turnkey received the infection, and has not had it a second time, although he has attended constantly during the distemper of this last winter, and for these six or seven and twenty years past. Stevens's father, an elderly man, came from Harietsham to see him, took the infection and died, as did his mother; likewise his father's sister, Mary West, who went to see her brother, caught it and died.

Mr. Waller, who was surgeon to the gaol forty-two years, caught the fever the second year of his attendance, and although he attended the sick of  
the

the distemper, without ever sparing himself, in many succeeding attacks of it, yet he never caught it a second time: He was fully persuaded, that after having the distemper once, there was not much danger of it again. The same gentleman observed, that every sailor brought into the prison, that had the fever while belonging to infected ships, or prisoners that had it in other infected prisons, did not receive the infection in this gaol, although no steps were taken to keep them from the diseased. ;

Mr. Peckham, the surgeon of the prison at this time, suffered an attack of the fever, when it broke out last July, was ill the usual time and recovered. He has shewn unremitting attendance to the sick during the last winter months, when the infection was so violent, without receiving any injury.

From the information which I have been able to collect, it appears that the distemper has been very violent in times past; as the gaolers and turnkeys have suffered by it very much, and as the fever was so violent among them who were only sometimes exposed to it, and who had clean linen, slept  
and



and eat much better than the prisoners could be supposed to have done ; it is probable the prisoners suffered as much in former times as of late ; all circumstances considered. The want of air and numbers crowded together seem generally to produce the gaol fever, this was the case in the prison here last winter ; the calendar contained a list of one hundred and six prisoners to be tried, whereas five years ago there were not more than twenty-three felons : This great increase of numbers accounts for the violent state of the infection, which at one time was so noxious, that two felons died suddenly, one, who had been drinking some beer fell down and expired instantly, the other died in a few hours after the distemper seized him.

X As to the full determination of the question, whether a man can have the infection of the gaol fever twice, or whether it is like the small pox and measles, which are said never to attack the same person more than once ; I cannot take upon me to determine a matter of such importance ; having had but small opportunities in the gaol distemper ; but if we were to judge from what I have been able to collect concerning the gaol fever in this prison

son for forty years back, we shall be led to believe that instances are very rare wherein the same person suffers twice from the true gaol fever. There may be instances of a person having the distemper twice or oftener ; but it is imagined that such cases are seldom met with, and that some of those persons who think they have had the complaint twice, or have attended others whom they suppose to have had it more than once ; may be mistaken, from the resemblance which *nervous fevers* with putrid symptoms bear to the gaol fever.

Sir GEORGE PAUL, in his enquiry into the defects of prisons, took notice of the hardships that persons were liable to from the gaol distemper, who were committed upon charges in themselves very slight, and sometimes not founded at all in truth.

The calendar of the prisoners tried here last lent assize presents us with an additional set of instances, where persons who have not been found guilty of any crime, and have been accordingly discharged, have been exposed to the distemper for a number of months. The calendar contains one hundred

and

and six to be tried on various charges, twenty of whom were acquitted, eight were discharged; some of the charges were so slight, that it seemed almost cruel to put them into the way of infection: for example, Ann Blackbourn committed, charged "on suspicion of stealing one " pewter pint pot," to remain "one month in " gaol." — Wm Brenchley committed the 22d. January, charged on oath with "stealing two " bushels of peas;" this man remained near two months in prison, some part of the time the complaint raged with great violence, and was at last acquitted.—John Cox and Francis Mills committed, charged with "stealing an iron wedge, and " some more bits of old iron."—Wm Eaton committed, charged with "stealing about one bushel " of coals."—Nathanael Knight and Wm Anderson committed, charged with "stealing a sack, " containing three bushels and a half of beans."—John Watkins committed, charged with "stealing " one silk handkerchief, and one pair of worsted " stockings." Discharged. These are some of the charges for which certain felons were committed, and upon which account they ran great risque of their lives. Out of the remaining number fourteen died

died of the gaol fever, the charges of some of whom were not capital. What seemed peculiar distressing, was, that the debtors were subject to the same fate with the felons. From the 11th. of August to the first of March, six debtors died, two of which were confined for ten pounds each, and one of the two had been in prison three years.

To exhaust a ward of its foul air, and to let in fresh ; I preferred the method of rarefaction ; by boiling lime and boiling vinegar, (alternately used) to hand ventilators ; and in order to enforce a strict performance thereof, rewards were given to the men intrusted with the charge ; and some few experiments on air were shewn, to convince them of the propriety of the procedure ; which effectually and almost instantaneously destroyed the infection ; and rendered the prison pure again, without the removal of a single prisoner ; contrary, I presume to the opinions of most people, acquainted with the condition of the prison at that time. The success this met with occasioned it to be discussed at a meeting of the *Maidstone Society for the diffusion of useful knowledge*, and a motion was made and carried ; that a copy of the plan I had given in, to the commit-

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tee ;

tee ; should be sent franked to every goal in the kingdom.

The following is a copy with a description of the engine used for the boiling liquor.

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C O P Y.

*To purify close infected Places, as Gaols, Hospitals, &c. communicated to the Committee appointed to superintend the Gaol.*

JANUARY 25th. 1784.

”TAKE of rue, wormwood, sage, lavender, mint, and rosemary, each an handful, put them altogether into a gallon of the best vinegar, and let it boil, and while boiling, let it be thrown to all parts of the room (viz. ceiling, walls, &c.) by a garden engine that has a fan or rose, that will divide the liquor into very small streams. After which, the room is to be well dried with a brazier, while the window next the external air is open and all the interior openings stopt ; then a little camphire may be carried in the room, burning in a fire-shovel.

N. B. If the room has the advantage of a fire place, the ingredients may be boiled there, and  
suffered

suffered to continue boiling sometime, while the steam is conveyed into the room.

If the room has no fire place, and is too close to burn charcoal, it may be kept boiling while it is playing on the infected places (if the engine is made of copper or tin) by a large heated iron placed under it.

It will be necessary while this is performing, that every door, window, or aperture that has not an immediate communication with the external air be close stopt, and as many openings next the external air be left open, as can with conveniency be admitted, that as the rarefied impure air is forced out, as much of the pure fresh air may supply its place as possible.\*

By the above method, what air is left impure after the rarefaction of the boiling vinegar, will be in a great measure corrected by the showers of vinegar falling through it. But as this method will render such rooms as are at the time inhabited, too wet to warrant such a procedure, the following

H 2

might

\* The opening and shutting of the different out and inlets must be strictly attended to.

might be substituted, particularly where no fire or fire place is allowed.

Let a wide shallow tub (or what is more commodiously used, the machine,)<sup>†</sup> that has its bottom perforated full of small holes, be placed on supporters, as near the ceiling as is convenient to pour in cold vinegar, and another on the floor, somewhat wider, immediately under the first, to receive the liquor as it falls; which will serve repeatedly in different parts of the room, 'till it has passed through most of the confined air.

Firing gunpowder will tend much to purify infected places, as the explosion will force out a considerable column of air, and make room for the admission of fresh, provided there is a communication with the external air as above recited; and the smoke will be the acid of sulphur.

And as a considerable portion of fixed air is generated in the bodies of men, and thrown out by the mouth as excrementitious; the passing of lime water through it occasionally, as the vinegar is directed

<sup>†</sup> The machine is here left out, as it is described in pages 39, 40, and 41.

ted to be done, will tend much to recover its salubrity, by the property it has of absorbing it. And as every substance burning by fire, either in flame or smoke, phlogisticates air, and renders it unfit for respiration, great care should be taken after fumigations of every kind, to get rid of the air thus impregnated with the inflammable principle, and to let in fresh before the return of the men. The closeness of the wards in this gaol renders the latter caution peculiarly necessary.

From a strict observance of the above method, fumigating with various substances, washing the walls, &c. with boiling lime, throwing quick lime from time to time down the necessaries and along the drains, frequent change of linen and other clothing, nutritive food, and constant attention to cleanliness; the men being washed daily with warm suds, and the clothes, &c. dried every week upon an oast with sulphur; the disorder so prevalent in this county gaol has been totally eradicated. Though few days past without fresh commitments, no more than two persons can be found to have taken infection after the adoption of these precautions."

(See



(See plate the second) A, a common garden engine made of stout copper, well revitted, to bear the heat of the fire, with a pipe and fan joined to the pump barrel, and made capable of any degree of elevation by means of screws.—B, the receiver for the heated iron, instead of its being placed under it, as mentioned in the directions given to the committee.—C, the heater and hook. The rim of the upper part of the heater shuts close on the top of the receiver to prevent the liquor from falling in.—D, the lever or pump handle.

As it was thought necessary to wash and scrape the walls of the cells, I chose the method laid down, to exhaust the wards of the foul air, by rarefaction of such ingredients as appeared a specific against contagious matters: Great care was taken to have every aperture leading to the internal part of the prison shut close, while all the openings next the *external air* were left open; that as the foul air was rarefied, and from its lightness, made to pass out of the upper part of the openings, fresh air might be admitted in at the lower part. The engine at the same time playing in all directions, in every corner and crevice of the room,

must





must, of necessity force out the impure air, and pure wholesome air supply its place, when the room is thoroughly dry and cooled: And as the fresh atmospheric air admitted, is more dense, than air spoiled by respiration, it will not immediately be changed or mixed with the impure air, if the communications are not frequently opened, or left open any length of time.

To prove that plogificated air passes out at the upper part of an opening, while fresh atmospheric air is admitted at the bottom, is evident, from that simple but useful discovery of Dr. Hales; that if the air of a room be heated, and the door thrown open, and a lighted candle held to the upper part of the door-way, the flame will be driven out by the more rarefied air passing out above; but if held near the bottom, the flame will be forced in by the cold air rushing into the room; and between the two currents the flame will become stationary.

The common method of fumigating rooms by burning substances, has not in general the desired effect; especially in large places, where several

rooms

rooms join; and although every thing burning rarefies the air as well as the boiling lime; yet as little or no attention has been paid to the opening and shutting the out and inlets of rooms, (as if some specific substance was thought to rise in fume, from fumigations, sufficient to correct the noxious particles in the air and render it sweet) I have therefore suggested this precaution. I am very doubtful with regard to many substances, burning either in flame or smoke, whether they have this effect, any farther than as being instrumental in forcing out foul and letting in fresh air; therefore if proper attention be not paid to the different openings, those fumigations are in a great measure of no effect, but render the included air more unfit for respiration.

## A P P E N D I X.

**T**H E common atmospheric air, that vivifying element, without which, a single moment would put a period to all animals; deserves the attention not only of those that have applied themselves to philosophy, but of every man, that he may profit by the advantage, and avoid the danger of peculiar situations. This elastic fluid is diffused universally, where ever life by the wisdom of the omnipotent is intended to subsist; and its good and noxious qualities require a particular description by ingenious men, from accurate observations and experiments; that many useful members of society may not ignorantly run themselves into an invisible fluid, rendered more deleterious in its quality by noxious vapours, than the most known chemical poisons. But as neither my time or abilities are sufficient for a proper explanation of this subject, I must leave it for some ingenious person, more capable of instructing those who are ignorant of the principles and properties of the different airs; and content myself with communicating to the public a few experiments,

that will, I flatter myself, tend to preserve the health of those whose constitutions may have been frequently injured by an invisible cause, that had escaped the observation of many valuable men, whose health would have been of importance to the community.

Air is well known by every body to be absolutely necessary to support life; and the alterations made in that fluid by rarefaction and condensation, affect delicate and impaired constitutions, nay the most robust, at different times and seasons, do not escape its effects; and may we not attribute many slight illnesses, which being frequently renewed produce violent diseases; to the construction of many of our modern sitting rooms? particularly in large towns, where, the student that he may occupy as small a space of the house as possible, confines himself to a close room; and the tradesman brings himself and family to a small apartment, for the conveniency of his employment.

The artist finishing the apartments is particularly attentive to make the door shut as close as possible, and if he is not able to complete this to his

satisfaction

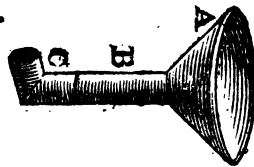
satisfaction, borders it round with list or some other contrivance to prevent the room from being called a cold one: The consequence of this is, that after the fire has been lighted for some time and people have breathed in it; the air is rendered too rare, from the want of a free admission of fresh air. A person confined sometime thus surrounded with such a heated medium, will find, on a sudden exposure to the cold external air, disagreeable effects, that may from frequent repetitions produce serious consequences. And on the other hand, if the door or windows do not shut close, streams of cold air are pouring in upon us as we sit near the fire, from every crevice or opening, in proportion to the magnitude and heat of the fire; which if not quite so destructive to the constitution as the former, is at least, pernicious in a degree, and often produce severe illnesses.

To prevent the ill effects of these causes I have contrived a tube, to be placed through the wall, in a corner or some other convenient part of the room, three or four inches from the ceiling.



(See fig. 1st.) A, the outer or external part, is broad like the bell part of a French horn, for the more easy admission of the external air through B the tube, into C the elbow, the extremity of which is turned up to direct the admitted air to the ceiling; against which, it is reflected and diffused through the more rarefied air of the room, to keep up a proper equilibrium, without a stream or current of cold air, coming on any person in the room; the doors may then be made to shut close by lifting or any more eligible contrivance of the mechanic; as a sufficient supply of fresh air will be continually pouring through the tube, in proportion to the quantity of fire, without any inconvenience from its admission.

Fig. 1st.



A lighted candle will not be affected by the air, coming in this way, when held at the distance of six inches from the side of the tube, either above or below its extremity; though when held over the end of it, between that and the ceiling, it will be  
blown

blown out with great force ; when there is much fire in the chimney, and the door and windows close shut. If the door, or a larger opening than this tube, is open to the external air, it will not have that effect, as air always endeavours to force itself through every crevice 'till it has made an equilibrium ; therefore if a large opening is made, from a door or window, this is done instantly, and the small openings have but little effect, but immediately when the door or window is shut, the tube acts again, and you breathe fresh air constantly without any disagreeable effects.

The wonderful effect air has in altering and changing of things, is evident to most people ; and it is no less effectual in preventing chimneys from smoking, when a sufficient quantity is admitted. If the diameter of the orifice of the tube be insufficient for the admission of the air, a long narrow horizontal opening may be made near the ceiling, at the greatest convenient distance from the fire place, equal at least to the diameter of the smallest opening of the door or window, which is found to cause the ascent of the smoke up the chimney ; in front of which opening, a slip of wood is to be placed,

placed, to direct its course to the ceiling, which may be ornamented like a cornice, or what best answers the appearance of the room.

(See fig. 2d.) A, the black line, representing the narrow slip cut through the wall.—B, the cornice, sunk down to shew the opening; which when in its proper place should be quite behind, and at the bottom part of the cornice.

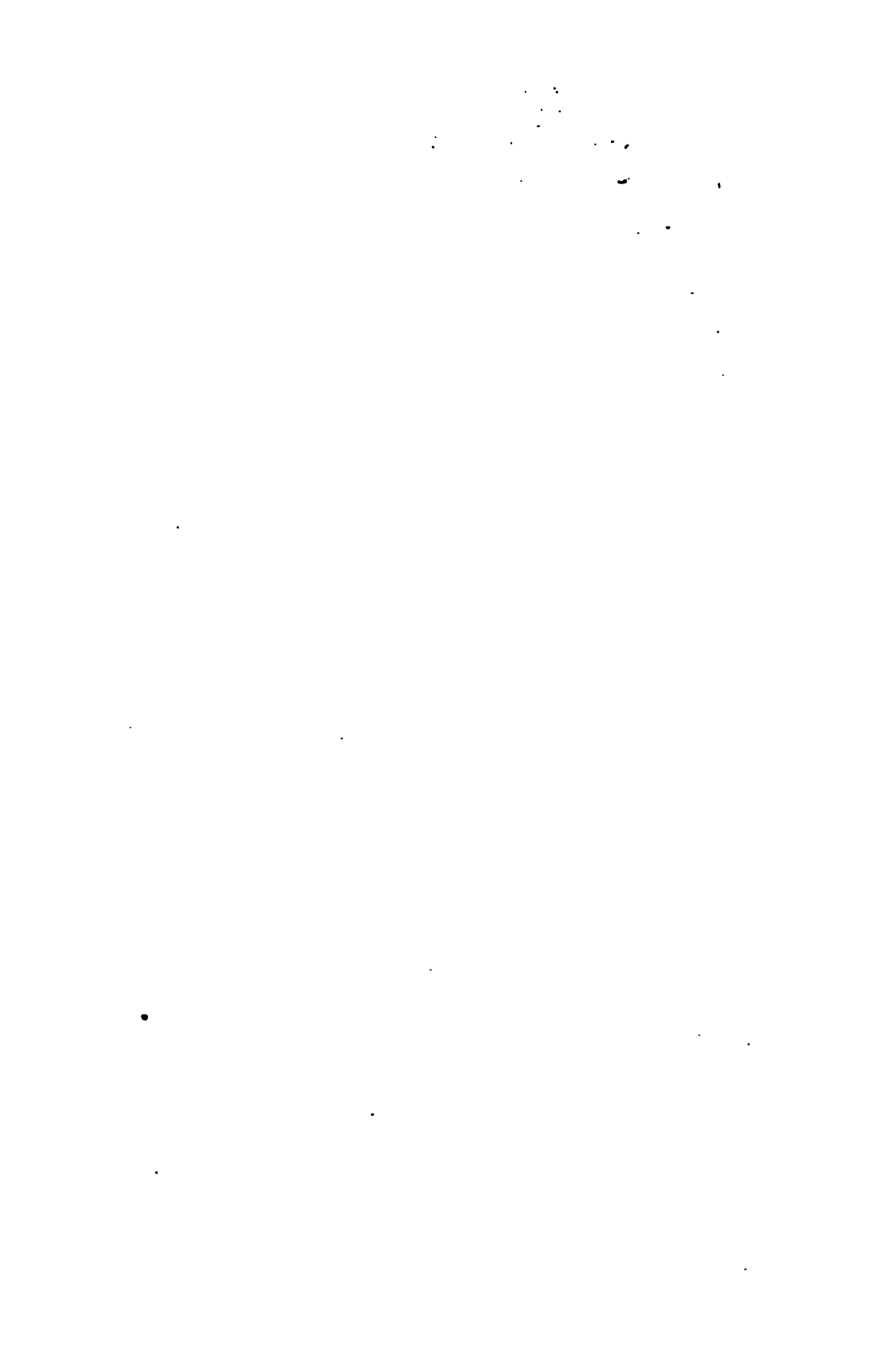
Fig. 2d.



This will always answer where the opening of a door or window a little way is effectual, provided the inlet is equal to that of the door or window; and the air is best brought from the external part of the house from its most healthy situation. On this side of the house there should be no dunghill, ditch, or any accumulation of filth, that the atmospheric air, which we admit may be as pure as can conveniently be obtained, that being more dense than the internal air, which is loaded with phlogiston by breathing, burning of candles, and other phlogistic processes; and puts in motion the rarefied air  
within

within, and causes it to bend its course to the current up the chimney, made by the rarefaction of the fire, without letting in air in a cold stream on any person in the room, as is done by leaving a door or window a little open. By these means no more air will be admitted than is necessary for the purpose, and is conducive to health; thus the air that has served for respiration is quickly discharged, as that which is most phlogificated is lighter than the rest, and consequently driven to the fire place, and there being more rarefied, it rises in the funnel and goes out; the other air in the room flowing towards the chimney is likewise rarefied in its turn and carried away, so that there is a continual change of air without being incommoded, either with heated impure air, or cold streams of air rushing into the room through every crevice or avenue; whereas, when tubes or pipes are fixed within the fire place, the air brought through them serves the current, and leaves the respired air within the room until it finds some outlet to make its escape by, consequently we are obliged to breathe the same air, more frequently than in the other way of admittance.

F I N I S.



1875

1876







